

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

741118-53

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/869341

INTERNATIONAL APPLICATION NO.

PCT/DE99/02091

INTERNATIONAL FILING DATE

06 July 1999

PRIORITY DATE CLAIMED

28 December 1998

TITLE OF INVENTION ELECTRIC MOTOR WITH ELECTROMAGNETIC BRAKE

APPLICANT(S) FOR DO/EO/US Michael HABELE et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to promptly begin national examination procedures (35 U.S.C. 371(f)).
4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☐ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
14. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
15. ☒ A **substitute specification which contains no new matter and marked up copy**.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☒ Other items or information:

(1) One Sheet of Drawings (Figs. 1-3)
Application Data Sheet

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PCT/DE99/02091

JUL 18 2001 PCT/PTO 2 8 JUN 2001

11118-053

21. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 CFR 1.492(a)(1) - (5)):**

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO..... **\$1000.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO..... **\$860.00**

International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(3)) paid to USPTO..... **\$710.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)..... **\$690.00**

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)..... **\$1000.00**

ENTER APPROPRIATE BASIC FEE AMOUNT =

Surcharge of **\$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	15- 20 =	0	X \$18.00
Independent claims	1- 3 =	0	X \$80.00

MULTIPLE DEPENDENT CLAIM(S) (if applicable) + \$270.00

TOTAL OF ABOVE CALCULATIONS =

☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.

SUBTOTAL =

Processing fee of **\$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).

TOTAL NATIONAL FEE =

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **\$40.00** per property +

TOTAL FEES ENCLOSED =

Amount to be refunded:

\$

charged:

\$

a. ☒ A check in the amount of **\$ 860.00** to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. 19-2380 in the amount of \$ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-2380. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO

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SIGNATURE

David S. Safran

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Reg. No. 27,997

REGISTRATION NUMBER

JC18 Rec'd PCT/PTO 2 8 JUN 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant Michael HABELE et al

Serial No Unassigned

Filed : On Even Date

For : ELECTRIC MOTOR WITH
ELECTROMAGNETIC BRAKE

Examiner:
To be Determined

Art Unit:
To be Determined

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Entry of the following amendments is requested preliminary to calculation of the filing fee and examination of the above-captioned application.

IN THE CLAIMS:

Please cancel original claims 1-17, and add the following new claims:

18. An electric motor comprising a rotor, an electromagnetic brake means, and a stator wherein said stator comprises at least one pole pair in which at least one pole of said pole pair comprises a pole shoe which faces towards the rotor and supports a stator winding, and wherein the stator supports the electromagnetic brake means between the ends of the at least one pole of the stator, and the electromagnetic brake means comprises a brake element composed of an electromagnetically conductive material which is urged against a braking force by an attraction force generated by the magnetic flux induced during operation of the motor, wherein said brake element is constructed in the shape of a rocker element and is supported by the stator to pivot about an axis such that the brake element applies a braking force to the rotor at a position offset from said axis.

brake arm.

26. An electric motor as set forth in claim 23, wherein the disengagement arm of the brake element includes a portion of the pole face to form an annular gap with the rotor to define a motor air gap.

27. An electric motor as set forth in any one of claims 23, wherein the brake arm is located in front of the axis about which the brake arm pivots when viewed in the direction of rotation of the rotor and the disengagement arm is located behind said axis in the direction of rotation of the rotor.

28. An electric motor as set forth in claim 24, wherein the brake arm comprises a brake lining which has little or no magnetic conductivity.

29. An electric motor as set forth in claim 23, wherein the brake arm has a plurality of blind holes each of which supports one end of a compression spring providing the braking force.

30. An electric motor as set forth in claim 29, wherein the other end of the compression spring is supported on a steady which is attached to the stator.

31. An electric motor as set forth in claim 23, wherein the disengagement arm includes a separating face having a short-circuited turn formed in said face.

32. An electric motor as set forth in claim 18, wherein the electric motor has a pole pair comprising two poles in which each pole contains an electromagnetic brake means.

REMARKS

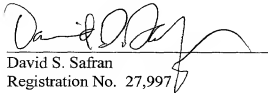
This Preliminary Amendment filed concurrently with the National Stage (under 35 U.S.C. 371) application papers for International Application No. PCT/DE99/02091 replaces the claims of the PCT application with new claims 18-32. The newly added claims define the positioning of the brake means between the ends of a least one pole of the pole pair formed by the stator.

The status of the claims is:

Claim 1-17 are canceled.

New claims 18-32 are pending.

Respectfully submitted



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JC18 Rec'd PCT/PTO 2 8 JUN 2001

Electric Motor with Electromagnetic Brake

Prior Art

The invention proceeds from an electric motor with an electromagnetic brake means as claimed in the preamble of claim 1. An electric motor with an electromagnetic brake is known (GB 920,485) which has a stator with two poles which each have a pole shoe which projects to the inside and which is surrounded by a stator winding. The brake means comprises a brake element for braking of the rotor of the electric motor which is located symmetrically within one pole at a time and which is subjected to a braking force in the middle. The brake element can be adjusted against the braking force by the magnetic field of the stator winding. The defect is that the arrangement of the brake element within the pole does not allow high disengagement forces so that the brake element can only be exposed to a relatively small braking force. The maximum attainable braking action of the brake means is therefore only low so that the brake means is not suitable for use for example in angle grinders.

Advantages of the invention

The electric motor as claimed in the invention with an electromagnetic brake means has the advantage of ensuring high disengagement force so that a high braking force can be achieved with the correspondingly good braking action. By making the brake element as a rocker on which the braking force acts outside its swivelling axis, the level of the disengagement force can be greatly increased. The brake means is thus much more efficient and is also suited for use in angle grinders.

The measures enumerated in the dependent claims enable advantageous developments and improvements of the electric motor as claimed in the invention.

Drawings

An embodiment of the invention is shown in the drawings and is detailed in the following description.

Figure 1 shows a partial section through an electric motor as claimed in the invention, Figure 2 shows a section through a stator half without a brake element which can be

inserted therein, and

Figure 3 shows a top view of a stator pack of the electric motor.

Description of the embodiment

In Figure 1 the electric motor, labelled 10, has a stator 11 and a rotor 12. The stator 11, of which only the upper half is shown, forms a pole pair, of which one pole is labelled 14. The pole 14 has a pole shoe 15 which is pointed from the yoke 13 to the inside to the rotor periphery, and which emerges on both sides in pole horns 16, 17. Between the pole horns 16, 17 and the yoke 13 recesses 18, 19 are formed into which a stator winding 20 fits. The stator winding 20 thus surrounds the pole shoe 15.

In the stator 11 in the area of the pole shoe 15 a radially continuous free space 21 is formed into which a brake element 23 of a brake means 22 is inserted. The brake element 23 fills the inner part of the pole shoe 15 between the pole horns 16, 17. The brake element 23 forms lateral separating surfaces 24, 25 which pass radially relative to the stator 11 and the pole face 26 facing the rotor 12. The brake element 23 is made of magnetically conductive material so that passage of the magnetic flux induced by the stator winding 20 in the stator 11 and in the brake element 23 takes place in the separating surfaces 24, 25 and in the pole face 26.

The brake element 23 is made as a rocker which has one laterally projecting pin 27 each on the sides facing away from one another. The pins 27 form a swivelling axis 28 around which the brake element 23 is pivotally supported within limits relative to the stator 11. The brake element 23 is made as a multi-arm lever with lever arms 29, 30 which are located on either side of the swivelling axis 28. The lever arms 29, 30 are roughly at an angle of 180 degrees to one another, the brake element 23 being matched roughly to the ring structure of the yoke 13. The first of the lever arms 29, 30 forms a brake arm 29 which on the inside facing the rotor 12 bears a brake lining 31. The brake lining 31 is produced preferably from a material with little or no magnetic conductivity. The second of the lever arms 29, 30 is made as a disengagement arm 30 and in the area of the pole face 26 forms a narrow annular gap 32 with the rotor 12 which corresponds to the conventional motor air gap.

A compression spring 34 applies a braking force 33 to the brake arm 29 in the direction to the rotor 12. The brake element 23 is thus exposed to the braking force 33 outside of the swivelling axis 28, i.e. off-center, by which the braking moment around the swivelling

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When the electric motor 10 is turned on, i.e. current flows through the stator winding 20, in the stator 11 a magnetic flux is induced which produces an attraction force on the brake element 23 in the separating surface 25 towards the stator 11 and in the pole face 26 towards the rotor 12. This attraction force causes a quantitatively higher disengagement moment which is pointed opposite the braking moment and which causes a disengagement motion of the brake element 23 opposite the braking moment. In the separating surfaces 24, 25 there is sufficient play of motion for this purpose, which allows the braking element 23 to execute limited swiveling motion around the swivelling axis 28 relative to the stator 11, the brake lining 31 then being lifted by the rotor 12. The separating surface 25 on the disengagement arm 30 has a greater radial distance from the swivelling axis 28 than the separating surface 24 on the brake arm 29 so that the attraction force acting in the separating surface 24 makes an especially high contribution to the disengagement moment. Since the braking arm 29 in the area of the pole face 26 has a greater distance from the rotor 12 than the disengagement arm 30 and since the braking arm 29 bears a non-magnetic brake lining 31 there, there are no noteworthy attraction forces at this point, in contrast to the disengagement arm 30.

In order to prevent frequency-induced vibration of the brake means 22 when current flows through the stator winding 20, in the disengagement arm 30 there is a short-circuited turn 46 in the immediate vicinity to the separating surface 25.

When the electric motor 10 is turned off again, the magnetic action of the stator winding 20 abates so that the attraction force on the disengagement arm 30 likewise abates in the separating plane 25 and in the pole face 26. The braking moment then predominates again so that the brake arm 29 is pressed by the compression spring 34 against the rotor 12:

this leads to braking of the rotor 12. The brake means 22 therefore triggers automatically with the shutoff of the electric motor 10 so that for example in an angle grinder the coasting of the cutting-off wheel is automatically stopped a short time after the motor is turned off.

The stator 11, which is shown only in half-side in Figure 1 in the lower half of the figure which is not shown, has another pole which may or may not be provided with a brake which corresponds to the brake means 22. By providing another brake in a second pole the braking action can be further increased. In any case there the stator 11 is closed roughly in a ring-shape.

In Figure 2 the top half of the stator 11 from Figure 1 is shown without the brake element 23 which is to be inserted therein. It is apparent that the free space 21 is made axially not continuous, but is axially bounded by one segment 37, 38 at a time with continuous stator material. The free space 21 is thus made window-like; this is shown in Figure 3. The segments 37, 38 are each provided with semicircular recesses 35, 36 which are used as supports for the pins 21. In this way the swivelling axis 28 is formed.

The invention is not limited to the embodiment shown. Thus the brake means as claimed in the invention can also be used for more than two-pole electric motors. The braking force can also directly engage the brake lining or the component which bears it, the brake element then being used as a disengagement rocker which is coupled to the brake lining or the component which bears it. The compression springs can also be formed by one or more leaf spring sheets which are attached in the pole shoe 15 or to the stator 11 and produce the necessary braking force.

Claims

1. Electric motor with an electromagnetic brake, especially for an angle grinder, with a stator (11) which has at least one pole pair (14), of which at least one pole (14) has a pole shoe (15) which points to the inside towards the rotor periphery and is surrounded by a stator winding (20), the pole (14) accommodating a brake means (22) for braking of the rotor (12) which comprises a brake element (23) which can be adjusted against the braking force (33) by the magnetic field of the stator winding (20), characterized in that the brake element (23) is made as a rocker which is exposed to the braking force (33) outside of the swivelling axis (28).

2. Electric motor as claimed in claim 1, wherein the brake element (23) is inserted into a radially continuous free space (21) in the stator (11).

3. Electric motor as claimed in claim 2, wherein the free space (21) is axially bounded by one segment (37, 38) at a time.

4. Electric motor as claimed in claim 3, wherein the brake element (23) is supported to be able to swivel around the swivelling axis (28) within limits relative to the stator (11).

5. Electric motor as claimed in claim 4, wherein the brake element (23) is provided laterally with one pin (21) at a time which fits into recesses (35, 36) of the segments (37, 38) and forms the swivelling axis (28).

6. Electric motor as claimed in claim 5, wherein the swivelling axis (28) is parallel to the axis (39) of rotation of the rotor (12).

7. Electric motor as claimed in one of the preceding claims, wherein the brake element (23) consists of material with good magnetic conductivity and forms one pole face (26) which faces the rotor (12) and separating surfaces (24, 25) which face the stator (11).

8. Electric motor as claimed in claim 7, wherein the brake element (23) is formed as a multi-arm lever with one brake arm (29) and one disengagement arm (30), the brake arm (29) being exposed to the braking force and the disengagement arm (30) exerting a disengagement force opposite the braking force on the brake element (23) when current is flowing through the stator winding (20).

9. Electric motor as claimed in claim 8, wherein the brake arm (29) on the inside facing the rotor (12) is provided with a brake lining (31).

10. Electric motor as claimed in claim 9, wherein the separating surface (25) on the

disengagement arm (30) has a greater radial distance from the swivelling axis (28) than the separating surface (24) on the brake arm 29.

11. Electric motor as claimed in claim 9, wherein the disengagement arm (30) in the area of the pole face (26) forms an annular gap (32) with the rotor (12) which corresponds to a conventional motor air gap.

12. Electric motor as claimed in one of claims 8 to 11, wherein the brake arm (29) is located in front of the swivelling axis (28) viewed in the direction (40) of rotation of the rotor (12), conversely the disengagement arm (30) is located behind the swivelling axis (28).

13. Electric motor as claimed in claim 9, wherein the brake lining (31) has only little or no magnetic conductivity.

14. Electric motor as claimed in claim 13, wherein the brake arm (29) has a plurality of blind holes (41) which are used to hold one compression spring (34) at a time.

15. Electric motor as claimed in claim 14, wherein the compression spring (34) is on the other hand supported on a steady (45') which is attached to the stator (11).

16. Electric motor as claimed in claim 1, wherein in the disengagement arm (30) a short-circuited turn (43) is integrated.

17. Electric motor as claimed in one of the preceding claims, wherein the electric motor (10) has a pole pair consisting of two poles (14) which both hold one brake means (22).

Abstract

An electric motor with an electromagnetic brake is proposed, especially for an angle grinder, with a stator (11) which has at least one pole pair, of which at least one pole (14) has a pole shoe (15) which points to the inside towards the rotor periphery and is surrounded by a stator winding (20), the pole (14) accommodating a brake means (22) for braking of the rotor (12) which comprises a brake element (23) which can be adjusted against the braking force (33) by the magnetic field of the stator winding (20). The brake element (23) is made as claimed in the invention as a rocker which is exposed to the braking force (33) off-center. As a result of the off-center application of force the brake element (23) with the disengagement arm (30) can be arranged in the magnetic flux of the stator winding (20) such that a high disengagement moment can be achieved.

(Figure 1)

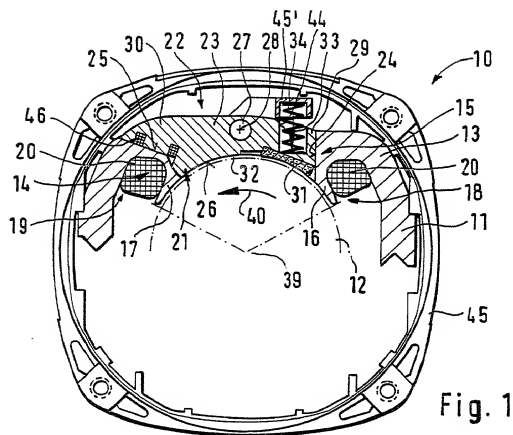


Fig. 1

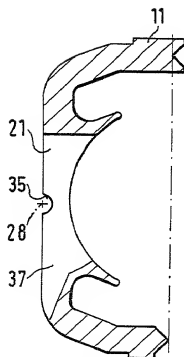


Fig. 2

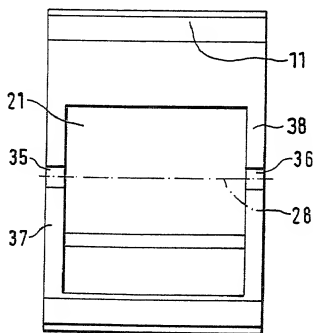


Fig. 3

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100

100

100

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DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN APPLICATION DATA SHEET (37 CFR 1.76) AND POWER OF ATTORNEY

As the below named inventor(s), I/we declare that:

This declaration is directed to:

- ☐ The attached application, or
- ☒ Application No. PCT/DE99/02091, filed on July 6, 1999
- ☐ as amended on _____ (if applicable);

I/We believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/We have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/We acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including material information which became available between the filing date of the prior application and the National or PCT International filing date of the continuation-in-part application, if applicable; and

All statements made herein of my/own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

I/We hereby appoint:

Practitioners at Customer Number 22204, as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

FULL NAME OF INVENTOR(S)

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Signature: X *Michael Habele* Date: X 30/5/11

Inventor two: Gerhard KRAEMER Citizen of: Germany

Signature: X *G. Kraemer* Date: X 30/5/11

Inventor three: Alfred ODENDAHL Citizen of: Germany

Signature: X *Alfred Odendahl* Date: X 11/06/01

Inventor four: _____ Citizen of: _____

Signature: _____ Date: _____

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09/869341

JC Rec'd PCT/PTO 28 JUN 2001

1-00
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Country of Residence:: Germany
Citizenship Country:: Germany

CORRESPONDENCE INFORMATION

Correspondence Customer Number:: 22204
Fax One:: 703-883-0370

APPLICATION INFORMATION

Title Line One:: MOTOR VEHICLE DOOR LOCK WITH ELASTICALLY
Title Line Two:: DEFLECTABLE COUPLING MECHANISM
Total Drawing Sheets:: 1
Formal Drawings?: Yes
Application Type:: Utility
Docket Number:: 741118-53